COURSE OUTLINE – subject to changes:

L-1  Mon  9 Jan  welcome to mcs 572 – supercomputing – measuring performance
L-2  Wed 11 Jan  scalability – types of parallel computing
L-3  Fri 13 Jan  high level parallel processing
      Mon 16 Jan  Martin Luther King, Jr., Day. No classes.

distributed memory parallel computing
L-4  Wed 18 Jan  basics of Message Passing (MPI) – broadcasting data
L-5  Fri 20 Jan  using MPI to write parallel programs
L-6  Mon 23 Jan  pleasingly parallel programs – Monte Carlo simulations
L-7  Wed 25 Jan  static and dynamic task assignments – load balancing
L-8  Fri 27 Jan  hands on supercomputing
L-9  Mon 30 Jan  partitioning and divide-and-conquer strategies

shared memory parallel computing
L-10 Wed  1 Feb  shared memory parallelism – an introduction to OpenMP
L-11 Fri  3 Feb  the work crew model with Julia, OpenMP, and pthreads
L-12 Mon  6 Feb  tasking with OpenMP – Bernstein’s conditions – task dependence
L-13 Wed  8 Feb  tasking with Julia – parallel recursive functions
L-14 Fri 10 Feb  evaluating performance – metrics, task graph, isoefficiency, roofline
L-15 Mon 13 Feb  work stealing – threading building blocks

acceleration with Graphics Processing Units
L-16 Wed 15 Feb  a massively parallel processor: the GPU
L-17 Fri 17 Feb  evolution of graphics pipelines
L-18 Mon 20 Feb  programming GPUs, OpenCL, CUDA, PyCUDA
L-19 Wed 22 Feb  introduction to CUDA
L-20 Fri 24 Feb  data parallelism and matrix multiplication
L-21 Mon 27 Feb  device memories and matrix-matrix multiplication
L-22 Wed  1 Mar  thread organization and matrix multiplication
L-23 Fri  3 Mar  review of the first 22 lectures
L-24 Mon  6 Mar  midterm exam

pipelining and synchronized computations
L-25 Wed  8 Mar  pipelined computations
L-26 Fri 10 Mar  pipelined sorting and sieving
L-27 Mon 13 Mar  solving triangular linear systems
L-28 Wed 15 Mar  synchronization with linear, tree, and butterfly barriers
L-29 Fri 17 Mar  parallel iterative methods to solve linear systems
L-30 Mon 27 Mar  domain decomposition methods
L-31 Wed 29 Mar  warps and reduction algorithms
L-32 Fri 31 Mar  memory coalescing techniques
L-33 Mon  3 Apr  performance considerations; NVIDIA tensor cores

applications
L-34 Wed  5 Apr  parallel FFT and sorting
L-35 Fri  7 Apr  parallel Gaussian elimination
L-36 Mon 10 Apr  GPU accelerated QR
L-37 Wed 12 Apr  case study: advanced MRI reconstruction
L-38 Fri 14 Apr  disk parallelism and cloud computing
L-39 Mon 17 Apr  concurrent kernels and multiple GPUs
L-40 Wed 19 Apr  GPU accelerated Newton’s method for Taylor series
L-41 Fri 21 Apr  final review
L-42 Mon 24 Apr  final project presentations
L-43 Wed 26 Apr  final project presentations
L-44 Fri 28 Apr  final project presentations

Wednesday 3 May, final exam, 1pm - 3pm, 303 Addams Hall.